Answer Key

Chapter 1

Page 5, Quick Check

1. the same
2. zero
3. (a) equilateral
   (b) right angle

Page 6, Quick Check

1. six ways
2. no difference
3. 260 m, 23° E of N
4. (a) 3 steps, 37° E of S
   (b) 17 steps

Page 10, 1.1 Review

1. (a) 720 N
   (b) 624 N
   (c) 360 N
   (d) 0 N
2. 5.0 N
3. 130 N, 22.6° E of N
4. 130 N, 67.4° S of E

Page 16, Practice Problems 1.2.1

1. (a) 0
   (b) 0
   (c) 0
2. F_4 is 2 grid squares in length, pointing right
3. F_x = 55 N. This component acts along the road

Page 20, Practice Problems 1.2.2

1. 30 km/h in the direction plane flying
2. 5.2° N of W
3. 287 km/h, 7.1° W of S

Page 21, 1.2 Review

1. (a) v_y
   (b) 12.3 m/s
   (c) 20.8 s
2. (a) v_x
   (b) 8.60 m/s
   (c) 179 m
3. 29.8° upstream
4. 60 N
5. 257 m, 29° E of N
6. 0.49 m/s, 12° to the right
7. (a) 22 km/h, 56° to the west
   (b) 1.5 km
8. (a) 240 N
   (b) 351 N
9. 19 km/h, 51.3° S of W

Page 26, Practice Problems 1.3.1

1. 94 N
2. 55°
3. (a) $1.96 \times 10^3 N$
   (b) So you don't have to include the weight of the beam in the calculation

Page 28, Quick Check

1. 5.00 m
2. Brother should sit half the distance of his little sister from the pivot and on the other side
3. 75 Nm

Page 33, 1.3 Review

1. 5.3 N
2. 37 cm
3. 6.1×10^2 N
4. 5.1×10^5 N
5. 69 N

Page 34, Chapter 1 Review

1. vectors have direction
2. 2.60×10^2 m, 67.4° E of S
3. 5.8 N, 31° W of N
4. (a) 56.0 N
   (b) 10.0 N
   (c) accelerate
5. 545 km/h (W), 779 km/h (N)
6. 852 km/h, 2.42° E of S
7. 5.0 km, 37° E of S
8. (a) 5.9×10^4 N
   (b) 6.9×10^3 N
   (c) 6.9×10^3 N
9. (a) 3.2×10^2 N
   (b) 6.9×10^2 N
10. (a) 250 N
    (b) 354 N
    (c) 500 N
    (d) 2.86×10^3 N
    (e) undefined (infinite)
11. (a) 500.0 N straight up
    (b) F_A=250 N; F_B=433 N
12. (a) 8.0 m/s at 37°E of the vertical
    (b) 2.5×10^3 s (42 min)
13. 1.9 m
14. 2.0×10^1 N
15. 9.9×10^2 N
16. F_A=1.1×10^3 N, down; F_B=2.3×10^3 N, up
17. 385 m
18. 1.5 s

19. 4.7 × 10^3 km from the center of the earth, or 1.7 × 10^3 km below the crust of the earth!
20. 34 N
21.

$$F_f L\cos\theta = \frac{1}{2}mgL\sin\theta, \text{ so}$$

$$F_f = \frac{1}{2}mg\frac{\sin\theta}{\cos\theta} = \frac{1}{2}mg\tan\theta$$

Chapter 2

Page 46, Practice Problems 2.1.1
1. 4.0 s
2. 2.0 m/s
3. -23.1 m/s^2

Page 48, Practice Problems 2.1.2
1. 0.204 m/s^2
2. 12.0 m
3. 4.71 s

Page 50, Practice Problems 2.1.3
1. 56.1 m/s
2. 92.4 m
3. 156 cm/s^2

Page 52, Quick Check
1. (a) 49 m/s^2
   (b) -9.8 m/s^2
   (c) 49 m/s^2
2. B (time 1.2 s)
3. 5.9 m

Page 53, 2.1 Review Questions
1. 5.3 × 10^2 km
2. (a) 0.28 m/s
   (b) 14 m/s
   (c) 22 m/s
   (d) 28 m/s
3. (a) 38 m/s
   (b) 47 m
   (c) 1.2 × 10^2 m
4. (a) Yes, car stops in 47 m
   (b) No, car stops in 59 m
5. (a)

$$v_f^2 = v_o^2 + 2ad, \text{but } d = 0,$$
$$\therefore v_f^2 = v_o^2$$
$$\therefore |v_f| = |v_o|$$

   (b) No, same speed but in the opposite direction
6. 3.0 m/s^2
7. 4.1 × 10^2 m
8. (a) 0.43 m/s^2
   (b) 2.6 s

Page 58, Practice Problems 2.2.1

1. (a) 4.5 s
   (b) 1.2 ×10^2 m
2. (a) 34 m/s
   (b) 6.9 s
   (c) 2.4 × 10^2 m
   (d) You drive a golf ball farther on the moon!

Page 62, 2.2 Review
1. 4.1 × 10^2 m
2. (a) 1.0 × 10^1 m
   (b) 2.8 × 10^2 m
   (c) Ouch! Yes!
3. 1.9 × 10^2 m
4. (a) 21 m/s
   (b) 12 m/s
   (c) 2.4 s
   (d) 51 m
   (e) 7.3 m

5i. (a) 17 m/s
   (b) 17 m/s
   (c) 3.5 s
   (d) 6.0 × 10^1 m
   (e) 15 m

ii. (a) 12 m/s
   (b) 21 m/s
   (c) 4.3 s
   (d) 51 m
   (e) 23 m

6. (c) v = (10.0 m/s^2)t + 2.50 m/s
   (e) v_x = 2.12 m/s

Page 65, Chapter 2 Review

2. 39.4 m
3. 34.3 m
4. 41 m (too short for a home run)
5. Misses by 3.0 cm
6. 34.5. It hits the wall 17.7 m above the firing point
7. 12.1 m
8. 27.7°
10. 28.5 m (about 29 m)
11. (a) v_f = ±8.3 m/s, t = 0.68 s and 2.4 s
    (b) as stone is going up it reaches 8.0 m and then reaches 8.0 m on the way down
12. Remember pebble is dropped from 1.8 m above the top of the window.

$h_2 - h_1 = \frac{1}{2}a(t_2^2 - t_1^2)$

$-1.8m = -4.9m/s^2(t_2 + t_1)(t_2 - t_1)$

Since $t_2 - t_1 = 0.25s$, (I)

-1.8m=-4.9m/s$^2(t_2 + t_1)(0.25s)$

$\therefore t_2 + t_1 = 1.47s$ (II)

Add (I) and (II): $2t_2 = 1.72s$

$\therefore t_2 = 0.86s$ and

$\therefore t_1 = 0.61s$

Solve for $d_1 = \frac{1}{2}at^2 = 1.8m$ above the top of the window

Page 72, Quick Check

1. $1.35 \times 10^3 kg$
2. $3.50 \times 10^3 N$
3. $40.0 m/s^2$

Page 73, Practice Problems 3.1.1

1. 13.9 N
2. 0.200 m/s^2

Page 77, 3.1 Review

1. 0.17 m/s^2 upward
2. a = 0
3. (a) 3.3 m/s^2
   (b) 6.5 N, No
4. If he allows himself to be accelerated down the rope at 1.3 m/s^2, the tension force in the rope will be lessened from 735 N to 637 N, which the rope can handle
5. (a) 4.66 m/s^2
   (b) 37 m/s
6. 4,5 m/s^2. Constant velocity when F = 0 (Terminal velocity)

Page 81, Practice Problems 3.2.1

1. 5.3 m/s
2. zero
3. 0.57 m/s

Page 82, 3.2 Review Questions

1. 3.0 × 10^{-3} kgm/s
2. (a) 5.4 × 10^2 kgm/s
   (b) -5.4 × 10^2 Ns
   (c) -4.5 × 10^2 N
3. Throw the camera in a direction away from the shuttle
4. Thrust is 6.0 × 10^7 N, which is greater than the force of gravity on the rocket
5. 0.77 m/s
6. The bullet which rebounds has $\Delta p = -\frac{3}{2}mv$. The bullet hitting modelling clay has $\Delta p = -mv$. Since $F \alpha \Delta p$, the rebounding bullet must exert a greater fore.
7. (a) -13.0 Ns
   (b) -1.3 × 10^4 N
8. 3.6 × 10^2 m/s
9. 12 m/s
10. -8.0 × 10^1 Ns, F = -16 N

Page 92, 3.3 Review Questions

1. 2.7 m/s, 37.5° E of N
2. 3.3 m/s, 58° S of W
3. (a) 5.0 kgm/s
   (b) 33 m/s, 37° to direction of first mass
4. Struck proton: 3.0 × 10^6 m/s, 60° from the incident proton's original direction. Incident proton: 5.2 × 10^6 m/s
5. 22 km/h, 12° E of S
6. 259 kgm/s, force exerted 17° E of S

Page 95, Practice problems 3.4.1

1. (a) 1.2 × 10^3 J
   (b) 1.4 × 10^3 J. No, effort force is less
2. 6.8 × 10^2 J
3. Since the ball is moving in a direction perpendicular to the force acting on it, **no work** is done. Since there is no force component in the direction of motion, no work is done.

Page 82, Quick Check

1. 0.72 J
2. 0.41 m

Page 83, Quick Check

1. Doubling speed increases E_k by 4 times, while doubling mass only doubles E_k
2. 42 kJ
3. 180 kJ

Page 104, 3.4 Review

1. 10 N
2. 4.9 × 10^2 J
3. Ball is slowing down, so force and work are negative
4. 3.46 × 10^3 J
5. 215 J
6. Car A as the velocity increases kinetic energy by the square
7. 7.2 × 10^{-2} J
8. 9 times
9. 370 J
10. 2.3 × 10^2 m

11. Both of you are correct. Calculating potential gravitational energy is relative to where you call zero.
12.29.4 J
13. 3.67 J
14. (a) 2.7×10^2 J
(b) 0.36 hp
15. (a) 2.63×10^5 J
(b) 263 kW

Page 107, Practice Problems 3.5.1
1. 0.24 J
2. 5.4 m/s, No
3. 15 m/s, No

Page 110, Quick Check
1. 5.0×10^2 m/s
2. 4.7 kg
3. 5.5×10^2 J, 4.4 m/s

Page 111, 3.5 Review
1. A
2. (a) $E_p = 0$ J; $E_K = 3.6$ J; $E_T = 3.6$ J;
(b) $E_p = 1.3$ J; $E_K = 2.3$ J; $E_T = 3.6$J;
(c) $E_p = 3.6$ J; $E_K = 0$ J; $E_T = 3.6$ J;
3. (a) 10.7 m/s
(b) No
(c) 12.5 m/s
(d) Masses cancel in final calculation
4. 2.2×10^2 J
5. 15 m/s
6. 1.71 m/s

Page 113, Chapter 3 Review
1. 0.467 m/s^2
2. (a) 5.88 m/s^2
(b) 4.70 N
3. 12.5 kgm/s
4. 4.00 Ns
5. 0.37 m/s
6. 2.2 m/s
7. 0.97 m/s
8. 0.59 m/s, 23° W of S
9. (b) 1.04 m/s
(c) 0.60 m/s
(d) 9.0×10^{-4}J
10. 12.3 kJ
11.6.9 kJ
12. 3.1×10^5 J
13. 1.47 MJ
14. Energy is use to change the shape of the modeling clay. Internal friction results in heating
15. The girl. The weightlifter does no work
16. 130 MJ
17. 21 m/s 2.1° W of N
18. 2.9 m/s^2
19. 1.7 m/s^2
20. If the block has a steady speed down the ramp, then $F_f = F_p$(magnitude only)

$$\mu = \frac{F_f}{F_N} = \frac{F_p}{F_N} = \frac{mg\sin\theta}{mg\cos\theta} = \tan\theta$$

21. 7.9×10^2 m/s

Chapter 4

Page 129, Practice Problems 4.1.1
1. 2.4×10^2 N
2. 7.1×10^4 N
3. (a) 9.68 m/s^2
(b) 1.2×10^4 N
(c) Car skids

Page 129, 4.1 Review
1. (a) 12 m/s
(b) 93 m/s^2
(c) 93 N
(d) the rope
(e) No. The force of gravity on the mass will make the rope dip below the horizontal
2. (a) 1.2 m/s
(b) 1.0×10^1 m/s^2
(c) 1.0×10^{-2} N
3. 8.91 m/s^2
4. 19.3 N
5. 27 m/s
6. (a) 3.4×10^{-2} m/s^2
(b) 2.0×10^{-4} Hz (17X faster than normal)
(c) You would feel 'weightless'
7. 2.0×10^2 N, 4.5×10^2 N
8. 6.5×10^3 N
9. 7.1 m/s
10. (a) 5.95×10^{-3} m/s^2
(b) 3.6×10^{22} N (gravity)
11. 11 m/s
12. (a) 33 m
(b) Bank the curve towards or facing center. Then a component of F_g provides some centripetal force

Page 135, Practice Problems 4.2.1
1. 1.9×10^8 s
2. 2.8×10^4 s

Page 138, 4.2 Review
1. 12 a
2. At D
3. 4R
4. 27 a
5. 1.02×10^{13} m^3/s^2
6. 4.24×10^7 m

7. (a) 76 a
(b) $R_{mean} = 2.7 \times 10^{12}$ m
(c) $R_{max} = 5.3 \times 10^{12}$ m
(d) Between Neptune and Pluto

8. 0.62 a

Page 142, Practice Problems 4.3.1

1. (a) 7.5×10^{-8} N
(b) 4 times as uch

2. 113 N
3. 253 N

Page 145, Quick Check

1. a = g
2. 616 N
3. 7.9×10^3 m/s
4. Your weight is primarily due to the gravitational attraction of the massive earth

Page 146, Quick Check

1. 7.35×10^3 m/s. No. $\frac{mv^2}{R} = \frac{Gmm}{R^2}$
2. 7.4×10^3 m/s

Page 148, Quick Check

1. 9.9×10^{21} kg
2. (a) 1.47 N/kg or 1.47 m/s^2
(b) 2.79×10^3 m/s

Page 149, 4.3 Review

1. 1.72×10^3 N
2. 2.7×10^{-3} m/s^2
3. 1.0×10^3 m/s
4. G appears to be constant anywhere in the universe, but g varies as $1/R^2$, therefore g is constant only at a given distance from the attracting planet
5. (a) 1.62 m/s^2 or 0.17g
(b) 3.31 m/s^2 or 0.34g
(c) 1.47 m/s^2 or 0.15g
(d) 273 m/s^2 or 28g - Mercury
6.

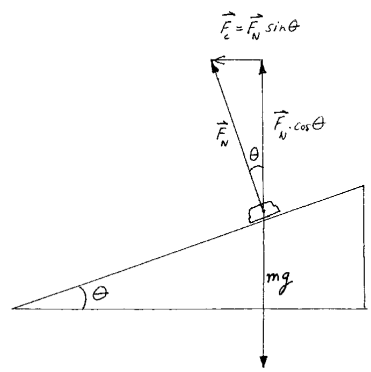
$$\frac{GMm}{R^2} = \frac{m4\pi^2R}{T^2};$$

$$\therefore M = \frac{4\pi^2R^3}{GT^2} = 6.02 \times 10^{24}\,kg$$

7. 2×10^{18} N
8. 5.4 m/s
9. 41 m
10. 1.1×10^4 m/s
11. Sun: 6.2×10^5 m/s
Moon: 2.4×10^3 m/s
Mars: 5.0×10^3 m/s
12. Venus is easier. To go to Mars you have to move away from the sun. Toward Venus the sun's gravitational pull helps you

Page 151, Chapter 4 Review

1. 3.3×10^2 N
2. 6.0×10^2 N
3. (a) 14 m/s
(b) 56 m/s^2
(c) 69 N
4. 5.2×10^3 s (1.4h)
5. 1.8×10^3 N
6. 542 N
7. 90.0 N
8. (a) January (Kepler's Second Law)
(b) January ($F \propto 1/R^2$)
9. (a) 686 N
(b) 2.3×10^{-9} N
10. 2.0×10^1 N
11. 3.1×10^6 m
12. 2.64×10^6 m
13. (a) 7.9×10^3 m/s
(b) $v_{escape} = \sqrt{2}\, v_{surface\ orbit}$
14. 22 m/s
15. 3.4×10^8 m
16. 5.9×10^{23} kg
17. 0.472 km
18.



The road is banked so that the force F_N exerted by the road on the car is perpendicular, or normal, to the road surface. Since the surface is frictionless, the only forces acting on the car are the normal force F_N and the force of gravity, mg. A horizontal component of the normal force provides the centripetal force F_c. Note that on a truly frictionless surface, the required angle will only work for one particular speed v! On the diagram $\sin\theta = F_c/F_N$ and $\cos\theta = mg/F_N$

$$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{\frac{F_C}{F_N}}{\frac{mg}{F_N}} = \frac{\frac{mv^2}{R}}{mg} = \frac{v^2}{gR}$$

19. $g = \frac{Gm}{R^2} = G\frac{\rho V}{R^2} = G\frac{\rho}{R^2} \bullet \frac{4\pi R^3}{3} = \frac{4}{3}\pi G\rho R$

Chapter 5

Page 165, 5.1 Review

1. Both are charged particles, electron is negatively charged, proton positively charged and heavier
2. Positive charge is a lack of electrons; negative charge an excess of electrons
3. See Figure 5.1.6
4. See Figure 5.1.7
5. Clothes have been rubbing together and this has caused a transfer of charge between the various materials that make up the clothes.
6. Silk/glass: silk negative; Plastic/silk: silk positive
7. The neutral plastic spheres are attracted to the charged rod. Upon contact, spheres take on same charge as rod and are repelled.
8. The acetate strip will attract electrons, which will flow through the metal conductor to the acetate. The metal becomes positive and attracts electrons off the metal sphere of the electroscope. Both the sphere and the rod are positive, so they repel each other
9. Charge an electroscope positive, see if the comb repels it. If not, charge an electroscope negative and see if the comb repels it. Repulsion of like charges is the only sure test.

Page 169, Practice Problems 5.2.1

1. 41.4
2. 0.30 m
3. 5.27 μC

Page 172, Practice Problem 5.2.2

1. (a) 25.5 N, 61.4°
   (b) 188 N, 20.6°
   (c) 126 N, 11.9°

Page 175, 5.2 Review

1. (a) 2F
   (b) 4F
   (c) F/4
   (d) F/9
   (e) F
   (f) 16F
2. 9.0×10^{-3} N
3. 3.2×10^{11} N
4. 9.2×10^{-8} N
5. 1.8×10^{11} C, 2.8×10^{26} N
6. 12 μ C
7. 0.39 N directed along a line bisecting adjacent sides

8a. (i) 2.9×10^{26} N
(ii) 6.7×10^{-17} N
(iii) 4.3×10^{42} N!!!

9. Electrical force is 10^{39} times great than the gravitational force between a proton and an electron in a hydrogen atom
10. 1.5×10^{-8} m

Page 181, Practice Problems 5.3.1

1. 4.50×10^{-5} C
2. 4.5×10^{4} N/C
3. 3.00×10^{-4} N

Page 182, Quick Check

1. 1.4×10^{6} N/C
2 5.69×10^{-11} m
3. 3.5×10^{-12} C

Page 184, Practice Problems 5.3.2

1. III
2. 1.2×10^{5} N/C
3. -5.2×10^{4} N/C, to the left

Page 185, 5.3 Review

1. 2.0×10^{2} N/C, down
2. 1.4×10^{-16} N
3. 4.7×10^{-19} C
4. 1.8×10^{11} N/C, outwards from nucleus
5. 5.9×10^{4} N/C
6. 1.0×10^{10} N/C in a direction away from the charge
7. 4.0×10^{6} N/C toward the 36 μC charge
8. 3.3×10^{2} N/C
9. $E_A = 2.6 \times 10^{5}$ N/C, 11° left of the vertical and upward
10. 6.0×10^{-6} C
11. 9.6×10^{10} m/s^2

Page 189, Quick Check

1. Work is done moving electron to negative plate. High E_p. After release, electron moves away from negative plate and E_P converted to E_K.
2. High E_P at top of hill and near positive plate. E_P converts to E_K as going down hill or away from positive plate.
3. Double the field, hill twice as high. Half the field, half the height of the hill.

Page 191, Practice Problems 5.4.1.

1. -3.1×10^{-18} J (-19 eV)
2. r is the same, charge Q_B twice as much so twice as much electric potential energy
3. 2.44×10^{-9} m

Page 192, Quick Check

1. Increase E_P
2. Decrease E_P

3. Decrease E_P
4. Increase E_P

Page 194, Quick Check
1. 1.8×10^{12} V
2. 8.0×10^{-18} J
3. 5.00 C

Page 195, Quick Check
1. Decreases in half
2. (a) -5.0×10^{5} V
   (b) -5.0×10^{5} V

Page 196, Practice Problems 5.4.2
1. 1.5×10^{2} V
2. 3.6×10^{6} J
3. 6.00×10^{3} V

Page 197, Practice Problems 5.4.3
1. 6.4×10^{-21} J
2. 20 000 V

Page 198, 5.4 Review
2. 6.0×10^{-5} J
4. 2.8×10^{-1} J
6. 9.46×10^{-4} J
8. 2.3×10^{-17} J
10. (a) No; 1; 1
    (b) Yes; 2; 2
    (c) No; 1; 1
    (d) Yes; 2; 2
12. 60 V

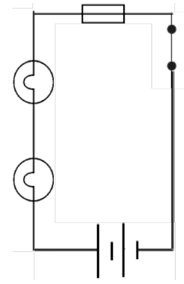
Page 202, Practice Problems 5.5.1
1. 2.38×10^{-3} m
2. 49.0 V
3. $\frac{V}{d} = \frac{\frac{J}{C}}{d} = \frac{\frac{Fd}{C}}{d} = \frac{N}{C}$

Page 207, Quick Check
1. 1.9×10^{7} m/s (0.063 c)
2. 4.4×10^{5} m/s
3. (a) 1.6×10^{7} m/s
   (b) 2.5×10^{3} N/C
   (c) 4.0×10^{-16} N
   (d) 4.4×10^{14} m/s^2
   (e) 3.1×10^{-9} s
   (f) 2.1 mm
   (g) 19 mm

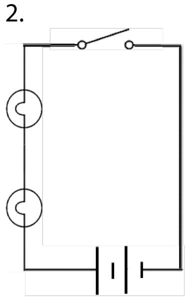
Page 211, 5.5 Review
1. 1.20×10^{3} V/m
2. 10 V
3. 0.57 m
4. 5.0 N/C from + to - terminal
5. (a) 5.0×10^{4} N/C
   (b) 8.8×10^{15} m/s^2
6. (a) 9.8×10^{-15} N upward
   (b) 4.8×10^{-19} C
   (c) Sphere is negatively charged
   (d) 3 excess electrons
7. Proton is heavier so has more E_K as reaches other plate
8. 7.7×10^{-8} kg
9. 240 m/s
10. 147 V
11. 0.60 cm

Page 214, Chapter 5 Review
1. (a) 4 F1
   (b) 4 F1
   (c) 256 F1
2. Electrons on the metal sphere are repelled to ground by way of the body. When the finger is removed, the sphere is left with a deficiency of electrons, so the sphere has a positive charge.
3. (a) 6.0×10^{-5} J
   (b) 3.0×10^{2} V
4. 9.2×10^{-16} N
5. 1.5×10^{11} m
6. 1.0×103 N/C
7. 4.8×10^{11} m/s^2
8. 9.0×10^{5} N/C (to the right)
9. 9.0×101 V.
10. (a) 4.2×10^{3} V/m
    (b) 6.7×10^{-16} N
    (c) 7.4×10^{14} m/s^2
11. 3.2 cm
12. 2.4 cm
13. 45 J
14. 1.44×10^{2} V
15. 0.75 F_1
16. 1.8×10^{6} V
17. 2.0×10^{-14} m
18. 6.9×10^{-17} J

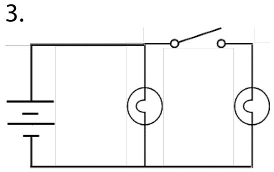
Chapter 6

Page 225, Quick Check
1.


2.



3.



Page 226, Quick Check

1. (a) 100 mA
   (b) 67 mA
2. (a) 16.7 mA
   (b) 6.7 mA
   (c) 3.5 mA
   (d) 0.67 mA

Page 229, 6.1 Review

1. 3.0×10^2 C
2. 1.0×10^1 A
3. 2.7×10^{23} electrons
4. 23 days
5. 1.8 g
6. 4.02 g
8. 80 mA

Page 231, Practice Problems 6.2.1

1. 1.5 kΩ
2. 12 A
3. 25 V

Page 233, Practice Problems 6.2.2

1. 2200Ω ± 220 Ω
2. 10 000 Ω ± 500 Ω
3. 1 500 000 Ω ± 150 000 Ω
4. 470 000 Ω ± 94 000 Ω

Page 234, Quick Check

1. 240 Ω
2. (a) 24 Ω
   (b) 24 Ω, 2.2×10^5 J
3. 4.5×10^5 J

Page 236, Practice Problems 6.2.3

1. 1.20 V
2. 0.030 Ω

Page 239 6.2 Review

1. 5.8 Ω
2. 6.0 V
3. 4.0 A
4. (a) 1.0×10^3 Ω
   (b) 6.0×10^3 A
   (c) 2.0×10^3 Ω
5. 6.0 Ω
6. 110 V
7. 5.0 A
8. 1000 Ω ±5%
9. (a) 320 Ω ±10%
   (b) 20 Ω ±5%
   (c) 85 000 000 Ω ±10%
   (d) 9700 Ω ±20%
10 (a) green black brown
   (b) orange purple orange gold
   (c) brown black black silver
   (d) grey blue red
11. 0.104 Ω
12. 8.1 Ω
13. (a) 3.6×10^6 J
   (b) 72 kWh
   (c) $4.32
14. 0.045 kWh
15. 22 V
16. 5.0 A

Page 245, Practice Problems6.3.1

1. (b) 1.1 A
2. (a) 9.0 Ω
   (b) 2.0 kΩ
   (c) 314 Ω

Page 246, Quick Check

1. 6.0 A
2. R/16
3. 1.5 A
4. (a) 6.0 Ω
   (b) 1.0 A

Page 251, 6.3 Review

1. 1.0 A
2. D
3. (a) 50 Ω
   (b) 1.0 A
   (c) 0.13 A
   (d) 7.3 V
4. 2.0 A
5. 10 V
6. 72 V
7. 0.50 Ω
8. (a) 91Ω
   (b) 0.13 A
   (c)).93 W

9. (a) 16 V
(b) 1.8×10^2 W

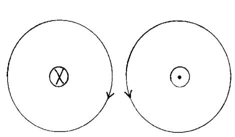
Page 254, Chapter 6 Review

2. 4.0×10^1 A
3. 2.7×10^{24} electrons
4. 24.7 g
5. 1.29 V
6. (a) 15 V
(b) 120 V
7. 30 kΩ
8. 80 V
9. 100 000 Ω ± 5 000 Ω
10. yellow, violet, green
11. 33 V
12. 12.5 A
13. 960 W
14. 144 Ω
15. I = 21.3 A; breaker is activated
16. 60 kWh, $3.60
17. 0.25 V
18. 7.5 V
19. (a) 44 Ω
(b) 4.0 Ω
20. 51.28 Ω
21. 3.0 V
22. 0.75 V
23. 18 kΩ, 9.0 kΩ, 2,0 kΩ, 4.0 kΩ
24. (a) 167 kΩ, 0.48 mA
(b) 77 Ω, 0.13 A
(c) 314 Ω, 5.2 mA
25. 3.0 V
26. 0.83 Ω

Chapter 7

Page 267, Quick Check

1. (a)



(b) The conductors will repel each other. The lines of force around both conductors are in the same direction in the space between them.

2. The Right Hand Rule predicts that end B is north

Page 272, 7.1 Review

9. 2.0 cm
10. (a) 0.70 cm
(b) 0.35 cm
11. 2.0×10^3 V
12. South

Page 275, Quick Check

1. (a) 8.0×10^{-15} N
(b) 8.8×10^{15} m/s^2, perpendicular to the velocity
2. 1.0×10^{-15} N
3. (a) Up, perpendicular to the magnetic field lines
(b) 1.2×10^{-10} N

Page 277, Quick Check

1. 8.0×10^{-3} T
2. 300 turns
3.159 turns

Page 282, 7.2 Review

1. 7.9×10^{-6} N
2. 3.0 N
3. 0.067 T
4. 0.60 N
5. 0.01A
6. 3.1×10^{-4} T
7. (a) 3.1 N
(b) 125 T
8. 5.3 A
9. 2.36 T
10. 9.1×10^{-3} T

Page 286, Quick Check

1. 9.1×10^{-31} kg
2. 1.7×10^{-27} kg

Page 288, Quick Check

1. 2R
2. 3.0×10^5 m/s; 8.4 cm

Page 293, 7.3 Review

1. 1.1×10^5 m/s
2. (a) R = mv/Bq
(b) 0.13m
(c) 2.9×10^{-21} kgm/s
3. (a) B
(b) 2.00 δ
(c) 0.707 δ

Page 294. Chapter 7 Review

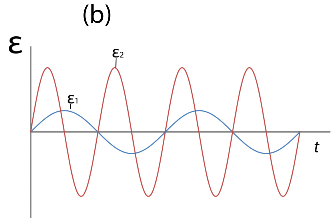
1. iron, nickel , cobalt
2. Electric field. A constant magnetic field will not affect a stationary charged particle
3. Lines of force are clockwise and circular
4. Lines are parallel for the length of the solenoid, going from S to N inside the solenoid
6. Out
7. 2.9×10^{-12} N

8. 6.3×10^{-2} T
9. 1.60 cm
10. 0.32 cm
11. 26 N
12. 1.7×10^{-3} T
13. 3.2×10^{-4} N
14. 1.5×10^{-2} T
15. 6.7×10^{-27} kg
17. attract
18. 6.5×10^{-5} V/m; 3.3×10^{3} V
19. 2.0×10^{6} V/m; 3.8 mm

Chapter 8

Page 302, Practice Problems 8.1.1
1. 0.38 V
2. 0.30 V
3. Into the page

Page 305, Quick Check
1. (a) Use a split ring commutator
   (b)



2. $\varepsilon = 4\pi NB\ell fR \sin\theta$
3. $\varepsilon = 2\pi NABf \sin\theta$

Page 309, 8.1 Review
1. left or right
2. Current direction: Y to X; Polarity of End B: S
3. Increase any of N, B, A or f
4. 60 km/s!
5. While switch S is being opened or being closed
6. 25 m/s
7. 5.2×10^{2} V
8. -1.0×10^{1} V

Page 314, Practice Problems 8.2.1
1. 2.5 V
2. - 0.10V
3. - 5.0×10^{3} V

Page 315, Quick Check
1. (a) 1.5 Ω
   (b) 2.4 V
   (c) 1.8 V
2. 11.1 V

Page 318, Quick Check
1. With DC, the rate of change of magnetic flux is zero, therefore the induced emf is zero also.
2. 600 V
3. (a) 1.20 V
   (b) 0.10 A

Page 321, 8.2 Review
1. 1.0×10^{-4} Wb
2. 0.48 V
3. 6.0 V
4. (a) 1.2 Ω
   (b) 1.5A
5. Overloading decreases f, which decreases back emf and increases current I, which may burn out the armature
6. $\text{Efficiency} = \dfrac{IV - I^2R}{IV} = \dfrac{1(V - IR)}{IV} = \dfrac{\varepsilon_B}{V}$
7. Since efficiency = ε_B / V, and ε_B α *f*, therefore efficiency increases at higher frequency

Page 323 Chapter 8 Review
1. A to B. Left end becomes north (Lenz's Law) Ampere's Right Hand Rule indicates current is from A to B
2. 0.10 V, 1.0 V/m
3. ϕ = BA
6. – 0.13 V
7. Right end is south
8. – 2.0×10^{5} Wb
9. 7.2×10^{3} V
10. $\varepsilon_2 = 4\varepsilon_1$ and $t_2 = \frac{1}{2}t_1$
11. 8.4 V
12. 0.67
13. 0.90Ω
14. (a) 24 A
    (b) 2.4 A
15. (a) 1.92×10^{3} V
    (b) 1.0 mA
    (c) 1.9 W
16. 2.0×10^{4} turns
17. 1.02 A
18. 23 V
19. 9.0×10^{4} V
20. 0.44 V
21. Out of the page
22. (a) 0.090 V
    (b) Top end
    (c) 1.2 V/m
23. 3.2 V
24. 2.0 %